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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/688,333	10/17/2003	Uri Cohen	JETS-02	2289

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EXAMINER	
WILKINS III, HARRY D	

ART UNIT	PAPER NUMBER
1753	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/688,333	COHEN, URI	
	Examiner	Art Unit	
	Harry D. Wilkins, III	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 June 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10 and 29-43* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10 and 29-43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/11/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status

1. Upon further consideration of the prior art of record, and in light of the recent developments relating to the Supreme Court decision in *KSR v. Teleflex*, new rejection grounds are set forth below, which the Examiner had previously indicated were overcome by Applicant's arguments. The Examiner wishes to apologize to Applicant for unduely extending the prosecution duration in this application.

Claim Interpretation

2. In order to set forth the proper metes and bounds of new claim 39, a certain amount of interpretation is required. Since claim 39 requires that wetting of the inside surfaces of the at least one opening is done by steps (a) and (b) alone, it specifically excludes an instance where the wetting of the inside surfaces is performed by immersing the substrate in any liquid other than the electrolyte. Thus, claim 39 cannot cover a process where (s) the substrate is immersed in an activation or wetting solution, (b) having ultrasonic or megasonic vibrations applied, then (a) immersing the substrate in the electrolyte, since such a process would include a process step (s) which wetted the inside surfaces other than steps (a) and (b).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 3-5 and 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tzanavaras et al (US 5,421,987) in view of Downes, Jr et al (US 2002/0189637) with evidence from Zhao (US 6,071,809, for claims 4-5 and 31-32 only).

Tzanavaras et al teach (see figure 1) a method for electrofilling a metal or alloy inside at least one opening located in a front surface of a substrate, the front surface of the substrate including at least one opening and a top field surrounding the opening, wherein the opening included a bottom and sidewalls coated with an exposed metallic surface, wherein the steps of the method included immersing the substrate in an activation solution (electrolyte), applying high pressure electrolyte jets to the substrate, wherein the electrolyte included metallic ions of the metal to be plated and applying an electroplating current to the substrate to electroplate the metal inside the opening.

Thus, Tzanavaras et al fail to teach applying ultrasonic or megasonic vibrations to the substrate prior to the onset of electroplating.

With respect to the step of applying ultrasonic or megasonic vibrations prior to agitating the electrolyte across the front surface of the substrate, it is noted that the problem being addressed by Applicant is that insufficient wetting of certain openings on the surfaces occurs when the substrate is immersed in the electrolyte.

However, that wetting problem was known, and a solution had been proposed by Downes, Jr. et al.

Downes, Jr. et al teach (see paragraphs 2-5 and 33-38) that when substrates having openings in the size range of 0.001-0.002 inches (25.4-50.8 microns) were immersed in a liquid, there were problems with adequate wetting within the openings.

Downes, Jr. et al teach that in order to avoid the problem of entrained air in the openings, ultrasonic or megasonic vibrations were applied to the substrate to dislodge any air within the openings to ensure proper wetting of the openings in the surface of the substrate.

Therefore, since the prior art recognized both the wetting problem associated with immersing substrates having openings surrounded by a field on a front surface of a substrate and the solution of using ultrasonic or megasonic vibrations to ensure adequate wetting of the interiors of the openings, it would have been obvious to one of ordinary skill in the art to have applied, prior to commencement of electroplating in the process of Tzanavaras et al, ultrasonic or megasonic vibrations to the substrate of Tzanavaras et al for the known purposes of ensuring adequate wetting of openings in the surface of the substrate in the size range of 25.4-50.8 microns.

Since the application of the ultrasonic or megasonic vibrations were needed when the substrate was immersed in the electrolyte, it would have been obvious to one of ordinary skill in the art to have applied the vibrations within the electroplating chamber.

Regarding claim 29, the act of applying the high pressure jets in Tzanavaras et al established turbulent flow of the electrolyte at the surface of the substrate.

Regarding claims 3 and 30, Tzanavaras et al teach (see col. 1, lines 7-13) that the process was applicable to electroplating through patterned masks (i.e.-where the bottom of the opening was metal and the sidewalls were non-metallic.

Regarding claims 4-5 and 31-32, in addition to the electroplating through a mask design discussed by Tzanavaras et al, conventional electroplating of microelectronic substrates includes forming openings, depositing a metal seed layer on the bottom and sidewalls of the opening, followed by electroplating of metal. Such steps are shown to be known and conventional in Zhao (US 6,071,809) in figures 3H-3K and cols. 6-7. Thus, it would have been within the routine skill in the art of electroplating to have utilized the conventional substrates of Zhao within the electroplating process of Tzanavaras et al.

5. Claims 2, 7-9, 34-37 and 39-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tzanavaras et al (US 5,421,987) in view of Downes, Jr. et al (US 2002/0189637) as applied to claims 1 and 29 above, and further in view of Langner et al (US 4,834,842) with evidence from Zhao (US 6,071,809, for claims 8-9, 36-37 and 41-42 only).

The teachings of Tzanavaras et al and Downes, Jr et al. are described above.

Neither of these references expressly teach that the electrolyte plating bath included an inhibitor additive.

Langner et al (see abstract and col. 1, lines 18-34) a conventional additive for copper electroplating baths included inhibitors. The inhibitors were added to ensure a uniform deposit.

Therefore, it would have been obvious to one of ordinary skill in the art to have added an inhibitor as taught by Langner et al to the electrolyte of Tzanavaras et al because the inhibitor increased uniformity of the electroplated metal.

Regarding claim 39, as above, the combination of Tzanavaras et al with Downes, Jr. et al teaches one of ordinary skill in the art to perform the wetting of the substrate within a single cell by immersing the substrate in an electrolyte and applying ultrasonic or megasonic vibrations.

Regarding claims 7, 35 and 40, Tzanavaras et al teach (see col. 1, lines 7-13) that the process was applicable to electroplating through patterned masks (i.e.-where the bottom of the opening was metal and the sidewalls were non-metallic.

Regarding claims 8-9, 36-37 and 41-42, in addition to the electroplating through a mask design discussed by Tzanavaras et al, conventional electroplating of microelectronic substrates includes forming openings, depositing a metal seed layer on the bottom and sidewalls of the opening, followed by electroplating of metal. Such steps are shown to be known and conventional in Zhao (US 6,071,809) in figures 3H-3K and cols. 6-7. Thus, it would have been within the routine skill in the art of electroplating to have utilized the conventional substrates of Zhao within the electroplating process of Tzanavaras et al.

6. Claims 6 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tzanavaras et al (US 5,421,987) in view of Downes, Jr. et al (US 2002/0189637) as applied to claims 1 and 29 above, and further in view of Reynolds (US 5,904,827).

Tzanavaras et al and Downes, Jr. et al fail to teach applying the ultrasonic vibrations during the electroplating treatment.

Reynolds teaches (see abstract, figure 3 and related description) including a megasonic transducer (90-92) for agitating the electrolyte in a copper electroplating process.

Therefore, it would have been obvious to one of ordinary skill in the art to have continued applying the ultrasonic vibrations to the substrate and electrolyte as taught by Reynolds to the method of Tzanavaras et al and Downes, Jr. et al because the ultrasonic vibrations would have increased uniformity of the electroplating (see Reynolds at col. 8, lines 45-56).

7. Claims 10 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tzanavaras et al (US 5,421,987) in view of Downes, Jr. et al (US 2002/0189637) and Langner et al (US 4,834,842) as applied to claims 2 and 34 above, and further in view of Reynolds (US 5,904,827).

Tzanavaras et al and Downes, Jr. et al fail to teach applying the ultrasonic vibrations during the electroplating treatment.

Reynolds teaches (see abstract, figure 3 and related description) including a megasonic transducer (90-92) for agitating the electrolyte in a copper electroplating process.

Therefore, it would have been obvious to one of ordinary skill in the art to have continued applying the ultrasonic vibrations to the substrate and electrolyte as taught by Reynolds to the method of Tzanavaras et al and Downes, Jr. et al because the ultrasonic vibrations would have increased uniformity of the electroplating (see Reynolds at col. 8, lines 45-56).

8. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tzanavaras et al (US 5,421,987) in view of Downes, Jr. et al (US 2002/0189637) and Langner et al (US 4,834,842) as applied to claims 39-42 above, and further in view of Reynolds (US 5,904,827).

Tzanavaras et al and Downes, Jr. et al fail to teach applying the ultrasonic vibrations during the electroplating treatment.

Reynolds teaches (see abstract, figure 3 and related description) including a megasonic transducer (90-92) for agitating the electrolyte in a copper electroplating process.

Therefore, it would have been obvious to one of ordinary skill in the art to have continued applying the ultrasonic vibrations to the substrate and electrolyte as taught by Reynolds to the method of Tzanavaras et al and Downes, Jr. et al because the ultrasonic vibrations would have increased uniformity of the electroplating (see Reynolds at col. 8, lines 45-56).

Response to Arguments

9. Applicant's arguments, see section III, filed 11 June 2007, with respect to the rejection over Tzanavaras et al in view of Hackett have been fully considered and are persuasive. The rejection of claims has been withdrawn because incorporation of the vacuum equipment of Hackett with the electroplating cell of Tzanavaras et al falls outside the realm of routine work since the electroplating cell would have required specific adaptations in order to be able to sustain the vacuum being drawn inside.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D. Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-F 7:45am-4:15pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Susy Tsang-Foster can be reached on 571-272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Harry D. Wilkins, III/

Harry D Wilkins, III
Primary Examiner
Art Unit 1753

hdw